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Findings and Recommended Actions

Findings

Setting

1. **California water planning and management requires full and balanced consideration of the State's richly diverse people, environments, businesses, land uses, climates, geology, and variable hydrology.**

   Diverse and variable water uses are distributed throughout the State and over time, which do not coincide with natural water supplies. As a result of increased competition among water uses, management of California's water system has become increasingly challenging, complex, and at times contentious. However, water issues are being resolved with leadership from the State and federal governments and partnerships with local and regional stakeholders. Local, regional, State and federal governments and water suppliers each have a role in improving water supply reliability for the existing and future population and the environment.

2. **Providing food and fiber crop products to Californians, as well as to other states and countries, consumes, and will continue to consume, more water than is consumed by all other household uses.**

   California is the top agricultural producer in the nation contributing over half of the nation's fruit, nut, and vegetable production. Many counties rely on agriculture as a primary economic contributor.

3. **Since the 1800s, California has experienced aquatic and riparian habitat degradation and declines in freshwater biodiversity throughout the State.**

   Hydraulic mining and gold extraction in the 1800s, dam construction and operation, pollution, flood control, urbanization, increases in Delta exports and upstream diversions, and introduction of exotic species have all contributed to the decline in ecosystem health. Flows on many rivers and streams currently do not resemble natural hydrographs, which is a contributing factor to impaired ecosystem functions, reduction and loss of native species and habitats, impacts on commercial fisheries, and degraded water quality.

4. **The linkage between water and energy management in California is complex and has both economic and environmental benefits and impacts.**

   a. Pumping, treating, and distributing water and wastewater consume approximately 10 percent of the State's total electricity. The State Water Project is the largest single user of electricity in the State.

   b. The use of fresh water for power plant cooling has increased because of new power plants, placing added pressure on the State's, and in particular local, water supplies.

   c. Hydroelectric plants produce about 15 percent of the State's electricity with relatively low production cost, no emissions, and the ability to meet critical peak demands; however, they have changed river flows, stages and temperatures and created barriers to fish passage.

Current Conditions

5. Since 1990, California's population increased from about 30 million to 36 million, and it is now growing by about 600,000 people per year. The Department of Finance projects that the State's population will reach about 48 million by 2030—an additional 12 million people.[1]

6. From a statewide perspective, California currently meets most of its water management objectives in most years. However, even today, water supply and quality challenges persist on local and regional scales.

a. Despite the increase in population, advances in water conservation and recycling, combined with infrastructure improvements including new storage facilities, have helped meet most demands. Cities use about the same amount of applied water today as they did in the mid-1990s, but accommodate 3.5 million more people. Water conservation and demand reduction strategies are expected to continue playing a prominent role in achieving future goals.

b. Most agricultural water demands are met in average water years, but in some areas, water used for agriculture has been transferred to urban areas, environmental restoration, and groundwater replenishment. Even in average water years, some growers forego planting and other agricultural operations because they lack a firm water supply. Farmers over the past 25 years have learned to grow 50 percent more crops per acre-foot of applied water by improving productivity and efficiency.

c. More water is dedicated today to restore ecosystems; however, some environmental requirements are not always met. Although significant scientific advancement is taking place, we do not fully understand ecosystem needs and their response to flows.

d. Some areas of California rely on over-pumping groundwater basins, which reduces available water supply, increases pumping costs, and in some areas degrades groundwater quality.

e. In many areas surface water and groundwater are impaired by natural and human-made contaminants that have effectively reduced the water supply that can be used. These contaminants degrade environmental resources, threaten human health, and increase water treatment costs.

7. California has not experienced the hardships and environmental pressures of a prolonged drought since the early 1990s, but we know that similar or worse conditions of unreliable water supplies can and will reoccur.

During long or extreme droughts, water supplies are less reliable and conflicts increase among water users. Water quality is degraded, making it difficult and costly to make it drinkable. Groundwater levels decline and many rural residents dependent on small water systems or wells run short of water. Business is adversely affected, jeopardizing the economy and irrigated agriculture. Ecosystems are strained, risking sensitive and endangered plants, animals, and habitats.

[1] The estimates for additional future water demands presented in this Water Plan Update are based on the period 2000 to 2030, which corresponds to a population increase of 14 million people, from about 34 million to 48 million.

8. **The deferred maintenance and aging infrastructure of State, federal and local water projects, including key water conveyance facilities and drinking water and sewage treatment systems, present risks to public safety, water supply reliability, water quality, and ecological health, due to faulty routine operation, short-term outages, and potential catastrophic failure.**

   Current infrastructure disrepair and outages are in part the result of years of underinvestment in preventative maintenance, repair, and rehabilitation. For example, some facilities of the State Water Project and the federal Central Valley Project have surpassed their design life and require significant rehabilitation or replacement. Infrastructure failures have disrupted water deliveries in recent years.

9. **California has a very large and complex water system with a highly decentralized system of governance involving State and federal agencies, thousands of local agencies, governments and private firms, and millions of households and farms.**

   This decentralization has a major influence on daily management, planning, and policy making. Competing and conflicting roles and responsibilities make it difficult to integrate regional water management. Differing roles of the various State, federal, and local governments during planning can create coordination difficulties. The organizational structure of State government has led to insufficient communication, coordination, and cooperation among numerous State agencies and departments responsible for water.

10. **Water rights in California are subject to State constitutional prohibition of wasteful or unreasonable use. Rights to use water are also subject to the State's obligation under the Public Trust Doctrine as trustee of certain resources for Californians.**

    California's water law and policy requires that "water resources of the State be put to beneficial use to the fullest extent of which they are capable" (Article X, Section 2 of the California Constitution). It places a significant limitation on water rights by prohibiting the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water. The Public Trust Doctrine is a legal doctrine that imposes responsibilities on State agencies to protect trust resources associated with California's waterways, such as navigation, fisheries, recreation, ecological preservation and related beneficial uses.

11. **Tribal water rights for water to meet tribal economic and cultural needs are often encroached upon or unmet.**

    California's water rights framework and federal Reclamation Act policies have evolved over the past 100 years, largely without regard to the water resources reserved for tribal lands. Previous water plan updates did not consider tribal interests or water demands.

12. **Californians from disadvantaged and under-represented communities continue to face inequities with respect to distribution of clean water, participation in water policy and management decisions, and access to State funding for water projects.**

    All Californians currently do not have equal opportunity or equal access to State planning processes, programs and funding for water allocation, improving water quality, and determining how to mitigate potential adverse impacts to communities associated with proposed water programs and projects.

Future Uncertainties and Scenarios

13. California lacks a consistent framework and standards for collecting, managing and accessing water data essential for regional integrated resource planning.

California's growing and changing water demands and supplies require more accurate and better managed information to reduce uncertainty in water planning. Existing data and analytical tools are not capable of providing complete answers to relevant questions about current and future water supplies, demands, and quality, as well as the management strategies needed to reduce controversy and conflicts by adapting our water system to changing water demands and supplies.

14. As a result of global climate change and other factors, California hydrology will likely not be the same as in the past century.

While many uncertainties remain, primarily on the degree and timing of change to be expected, it is likely there will be reductions to the Sierra snowpack, a rise in sea level, and earlier storm runoff. These changes have major implications for water supply, flood management, and ecosystem health.

15. Based on current trends, California's average-year water demand could increase between X.X million and X.X million acre-feet by 2030. This additional water would serve 14 million more Californians, sustain California's economy and agricultural industry, meet environmental restoration and water quality objectives, and eliminate groundwater overdraft.[2]

a. To acknowledge future uncertainty, this water plan update considered three plausible scenarios for 2030, rather than a single "likely future." One 2030 scenario is based on existing trends continuing into the future (current trends continued). Another scenario assumes California is more efficient in using water while growing its economy and restoring the environment (resource sustainability). The third scenario is based on a highly productive California, respectful of the environment, but with more people and lower water use efficiency than the other scenarios (resource intensive).

b. The water demands and supplies for these scenarios will be quantified by the next five-year California Water Plan update in 2008. For consideration now, the Department of Water Resources (DWR) estimated the additional average-year water demands by 2030 based on continuation of current trends. Water resources would be further stretched during long or severe droughts. One would expect the estimate for 2030 water demands to be lower for the "resource sustainability" scenario and higher for the "resource intensive" scenario.

[2] The estimates for additional future water demands presented in this Water Plan Update are based on the period 2000 to 2030.

Regional Planning and Diversified Strategies Improving Water Management

16. Regional planning efforts are now integrating a broader range of water management activities and addressing a wider range of interests.

Throughout California, stakeholders are beginning to work together in their regions and watersheds to develop programs that include multiple jurisdictions and provide multiple resource benefits. Water agencies in many regions are successfully employing a diverse mix of management strategies. Experience is showing that these regional efforts can result in solutions that are more closely tailored to meeting regional needs than additional, large-scale State or federal efforts. Overall, this increased focus on regional planning should result in solutions that solve water management problems more efficiently, consider other resource issues, and enjoy broader public support.

17. Local, regional, tribal, and statewide planners now have a diverse set of investment choices in the form of resource management strategies and essential support activities.[3]

a. The California Water Plan features, but does not prescribe, 25 resource management strategies from which regional, local, and State planners are and can select according to regional needs and goals. Thoughtful implementation of these strategies helps reduce conflicts among water users during multiyear droughts, protects water quality, meets the needs of the environment, and provides for many other regional water management objectives.

b. The plan also describes several support activities essential to integrate the resource management strategies and reduce uncertainty and risk. These activities include statewide and regional integrated planning and management, improving data and analytical tools, research and development, and science programs.

c. While not additive, the water supply benefits of the resource management strategies could meet or exceed the additional water demand estimate for 2030 average year conditions assuming the continuation of current trends. These supply benefits will be better quantified during the subsequent water plan update.

d. The plan includes actions in the Bay-Delta Program Record of Decision and is consistent with recommendations from recent State-sponsored water initiatives.[4]

[3] The 25 resource management strategies and essential support activities are listed in the Strategy Investment Options table presented after the recommended actions. They are described further in Chapters 1 and 4. Detailed narratives for the resource management strategies are presented in Volume 2.

[4] The Water Desalination Task Force, the State Recycling Task Force, the Stormwater Quality Task Force, the Floodplain Management Task Force, the Governor's Advisory Drought Planning Panel, and California's Groundwater (DWR Bulletin 118-03).

Recommended Actions

1. **California needs to invest in water conservation, efficient water management, and development of reliable, high quality, sustainable, and affordable water supplies to maintain and improve California's economy, environment, and standard of living.**

   To provide for the future, California must rely on a diverse set of water management strategies to (1) use and manage its existing water supplies efficiently; (2) implement new technologies to further water conservation, augment supplies, and improve water quality; and (3) increase water storage to improve flexibility and complement the benefits of other water management tools. To realize the full potential outlined in this water plan update, California needs significant and continuous investments for regional integrated planning, more public and private partnerships, project implementation, and better data and analytical tools.

2. **The State recognizes the critical role regions must play in California water planning and management and the need to better coordinate water planning with land use planning and urban development.**

   The State must provide incentives and assist regional and local agencies and governments to prepare their integrated resource and drought contingency plans on a watershed basis, to diversify regional resource management strategies, and empower regions to implement their plans. The State should assist cities, counties, and Local Agency Formation Commissions to prepare a Water Element for their general plans and help them implement existing legislation and State policies to improve coordination between water and land use planning.

3. **The State needs to lead water planning and management activities that (a) regions cannot accomplish on their own, (b) the State can do more efficiently, (c) involve inter-regional or inter-state issues, or (d) have broad public benefits.**

   These activities include, but are not limited to: (1) preparing California Water Plan updates as a public forum to integrate State, federal, regional, and local plans; (2) operating and maintaining the State Water Project; (3) providing regulatory oversight to protect public health and safety, including water quality, environmental protection, flood management, and dam safety; (4) participating in major regional initiatives, such as the CALFED Bay-Delta Program, and (5) forming public-private partnerships to implement regional programs like the Colorado River Quantification Settlement Agreement. Other State activities are included in the recommended actions that follow.

4. **California needs to develop broad and realistic funding strategies that define the role of public investments for water and other water-related resource needs over the next quarter century.**

   The State needs to lead an effort to identify and prioritize funding strategies to finance regional and statewide water planning, programs, and infrastructure. The State needs to clearly articulate when, and for what actions, to use public investments from State and federal sources. California's water finance plan must also recognize the critical role of local public and private funding based on the principle of beneficiary pays and user fees.

5. **California needs to rehabilitate and maintain its aging water infrastructure, especially drinking water and sewage treatment systems, operated by State, federal, and local entities.**

   The State should lead an effort, with input from public and private owners of water infrastructure, to identify and prioritize water infrastructure maintenance of key components with regional or statewide significance. This effort should also identify and implement financing strategies for continued public investments in the resulting infrastructure maintenance plan.

6. **California needs to define and articulate the respective roles, authorities, and responsibilities of State agencies and local agencies and governments responsible for water.**

   The State needs an internal review of how State resource agencies do business to identify ways to make these agencies more efficient, effective, and responsive to Californians. In light of the growing regional role in water planning and management, the State needs to redefine how to empower and assist regional water plans and programs. Establishing a cabinet-level strategic water team would strengthen coordination among State agencies responsible for water and ensure that their strategic plans and activities are consistent with the Governor's water initiatives and State policy.

7. **The State needs to inventory, evaluate, and deal with the effects of contaminants on surface water and groundwater quality.**

   The evaluation should include the effect of contaminants on long-term sustainable water resources in California, as well as cost-effective ways to improve water quality. To safeguard water quality for all beneficial uses, the State should also adopt a preventive strategy that promotes integration of source protection, pollution prevention, water quality matching, and, for drinking water, treatment and distribution.

8. **The Department of Water Resources, in cooperation with other State, federal, tribal, local, and research entities, should improve data and analytical tools needed to prepare, evaluate, and implement regional integrated resource plans and programs.**

   California needs better data and analytical tools to produce useful and more integrated information on water quality, environmental objectives, economic and equity issues, and surface and groundwater interaction. A consortium of public and private entities, with State leadership and stakeholder input, should prepare a long-term plan to peer-review and improve data and analytical tools, as well as develop presentation and decision-support tools to make complex technical information more accessible to decision-makers and resource managers. DWR should build and maintain the Water Plan Information Exchange (Water PIE), an online information management system, to assist regional and local agencies and governments.

9. The State should invest in research and development to commercialize promising water technologies and to help predict and prepare for the effects of global climate change.

The State should work with California research and academic institutions, like the California Academy of Science, California Council on Science and Technology, the University of California, and other universities and colleges, to identify and prioritize applied research projects leading to the commercialization of new water technologies and better scientific understanding of California's water-related systems. The State should also work with and assist researchers to monitor, predict and prepare for the effects of global climate change on California's water systems and the environment. DWR should develop alternative flow data to help State and regional planners test potential effects of global climate change on different management strategies.

10. DWR and other State agencies should explicitly consider public trust values in the planning and allocation of water resources to protect public trust uses whenever feasible.

The State should exercise continuous supervision over its navigable waters, the lands beneath them, and the flows of their tributary streams to protect the public's rights to commerce, navigation, fisheries, recreation, ecological preservation, and related beneficial uses.

11. DWR should invite, encourage and assist tribal government representatives to participate in statewide, regional, and local water planning processes and access State funding for water projects.

DWR should include tribal water concerns and water uses in future water plan updates and engage appropriate local, State and federal agencies to resolve tribal water issues that are identified.

12. DWR and other State agencies should encourage and assist representatives from disadvantaged communities and vulnerable populations, which have experienced disproportionate adverse health and environmental impacts, to participate in statewide, regional, and local water planning processes and access State funding for water projects.

Recent State policy establishes social equity and Environmental Justice as a State planning priority to ensure the fair treatment of people of all races, cultures, and income.

13. The CALFED Bay-Delta Program needs greater federal commitment, agency involvement, spending authorization, and funding to ensure continued and balanced implementation.

The State should continue to provide leadership for the CALFED Bay-Delta Program to ensure continued and balanced progress on greater water supply reliability, water quality, ecosystem restoration, and levee system integrity. The State should cooperate with the federal government to review and revise the implementation plan for the CALFED Bay-Delta Program to reflect the current fiscal climate, and accordingly adjust progress and expectations in all elements of the Bay-Delta Program to achieve balanced implementation.

Strategy Investment Options Table

California Water Plan Update 2004 provides local, regional, tribal, and statewide planners a diverse set of investment choices in the form of resource management strategies and essential support activities. They are summarized in the following Strategy Investment Options Table. Details on implementation and financing are in Chapter 5, and the resource management strategy narratives are in Volume 2.

The water plan features, but does not prescribe the 25 resource management strategies. Regional, local, and State planners can select strategies and essential support activities according to regional needs and goals. Thoughtful implementation of these strategies helps reduce conflicts among water users during multiyear droughts, protects water quality, meets the needs of the environment, and provides for many other regional water management objectives.

DWR, in consultation with other experts and stakeholders, developed the data and information presented in this table and in the narratives. The information is not directly comparable across strategies, but should be treated as preliminary indicators of the scale and type of potential benefits and associated estimated costs. In most cases, assumptions and methodologies are unique to given strategies, and neither benefits nor costs are additive among different strategies. Costs of actually implementing these strategies in specific locations could be significantly less or greater depending upon the extent of implementation that has already occurred and other local factors. Local and regional water management efforts should develop their own estimates of both costs as well as potential water supply benefits associated with any particular strategy.

Table Layout

The actions in the table are grouped by resource management strategies (top section) and essential support activities (bottom section), like planning and research & development. The table presents the resource management strategies in subgroups according to the type of strategy. Groupings include demand reduction, operational efficiency & redistribution of water, supply augmentation, water quality and resource stewardship. While these groupings are intended to aid review of the table, the 25 resource management strategy articles in Volume 2 Resource Management Strategies are arranged in alphabetical order so they can be more easily located. The Strategy Investment Options Table columns include:

- Column 1 shows the Resource Management Strategies (top section) and Essential Support Activities (bottom section) that are available to regions to achieve various water management objectives.
- Column 2 shows the estimated Potential Water Supply Benefits by 2030, with a footnote describing which benefit would be achieved and data sources. These benefits are displayed as average annual amounts in million acre-feet per year. A dot (•) is shown for strategies that would have a supply benefit that could not be quantified at this time.
- Columns 3-10 show other Water Management Objectives that could be achieved by implementing a strategy. A dot (•) is shown if a strategy could have direct and significant benefits for various water management objectives. In addition to these primary benefits shown with a dot (•), most strategies also provide other benefits as indicated in the strategy narratives.
- Column 11 shows a range of Cumulative Costs for each Option by 2030 of implementing a strategy or performing a support activity to achieve the indicated annual benefits by 2030 (not including ongoing operation and maintenance costs). These costs are displayed as the sum of costs over about the 25-year period. Details on implementation and financing are presented in Chapter 5.

Table Footnotes

General and specific notes are listed on the pages directly following the table.

Strategy Investment Options Table

	Water Management Objectives									Cumulative Cost of Option by 2030 Billion $	
	Provide Water Supply Benefit MAF per year	Improve Drought Preparedness	Improve Water Quality	Operational Flex & Efficient	Reduce Flood Impacts	Environmental Benefits	Energy Benefits	Recreational Opportunities	Reduce GW Overdraft		
Resource Management Strategies											
Demand Reduction											
Agricultural Use Efficiency	**0.3 – 0.6** (a)		●			●				**0.13 – 2.5**	(b)
Urban Use Efficiency	**1.5 – 2.5** (c)		●			●				**staff**	(d)
Operational Efficiency & Redistribution of Water											
Conveyance		●		●						**1.13**	(e)
System Reoperation	**0.15** (f)			●	●	●					(g)
Water Transfers	(h)	●	●	●		●				**staff**	(i)
Supply Augmentation											
Conjunctive Management & Groundwater Storage	**0.5 – 1.5** (j)	●	●	●					●	**1.5 – 4.5**	(k)
Desalination – Brackish	**0.1 – 0.3** (l)	●	●							**0.2 – 1.6**	(m)
Ocean	**0.2** (n)	●	●							**0.7 – 1.3**	(o)
Precipitation Enhancement	**0.3 – 0.4** (p)	●					●			**0.2**	(q)
Recycled Municipal Water	**0.9 – 1.4** (r)	●	●							**6.0 – 9.0**	(s)
Surface Storage – CALFED	**0.7 – 1.0** (t)	●	●	●	●	●				**3.3 – 5.6**	(u)
Surface Storage – Regional/Local	●	●	●	●	●						(v)
Water Quality											
Drinking Water Treatment & Distribution			●							**19.0 – 21.0**	(w)
Groundwater/Aquifer Remediation	● (x)	●	●	●						**20.0**	(y)
Matching Quality to Use		●	●							**0.08**	(z)
Pollution Prevention			●			●				**15.0**	(aa)
Urban Runoff Management		●	●		●	●					(bb)
Resource Stewardship											
Agricultural Lands Stewardship	● (cc)		●		●	●				**5.3**	(dd)
Economic Incentives (Loans, Grants, and Water Pricing)	● (ee)	●				●					(ff)
Ecosystem Restoration						●		●		**7.5 – 11.25**	(gg)
Floodplain Management					●	●		●		**0.48**	(hh)
Recharge Area Protection	(ii)	●	●						●		(jj)
Urban Land Use Management			●			●					(kk)
Water-Dependent Recreation								●		**0.02**	(ll)
Watershed Management			●		●	●				**0.48 – 3.6**	(mm)
Other Strategies	Objectives Vary by Strategy (See Narrative)										
Essential Support Activities to Integrate Strategies and Reduce Uncertainty											
Regional Integrated Resource Planning & Management										**0.25**	(nn)
Statewide Water Planning										**0.12**	
Data & Tool Improvement										**0.25**	
Research & Development										**0.25**	(oo)
Science										**3 – 5% of total**	(pp)

Note: Shaded boxes to be filled or may change

Notes for Strategy Investment Options Table

General Notes for Potential Water Supply Benefits by 2030 (shown in Column 2)

The ranges shown in Column 2 are estimates for potential demand reduction, redistribution of supply, and supply augmentation based on a review and aggregation of available information from existing studies.

Supply estimates may not be additive because various strategies can compete for the same water. For example, new surface storage may compete for the same water that could be used by conjunctive management strategies. The estimates may not be comparative because the estimates were derived from numerous studies based on different assumptions and data sources, as described below in Specific Notes (a) – (kk). In some cases, the values represent a local or regional benefit and may not provide statewide benefits. For example, water transfers that derive supply from land fallowing can redistribute water (that is, change of use of existing supplies) that may serve as additional supply from a local or regional perspective, but would not augment supplies from a statewide perspective. In addition, implementing some strategies, like water dependent recreation or ecosystem restoration may increase total water demands.

Specific Notes (a) – (pp):

(a), (b) Agricultural Water Use Efficiency – Reduce demand. Bay-Delta Program estimates for 2020 level of demand and Bay-Delta Program Solution Area only. This does not include Imperial Irrigation District water transfer. Subject matter experts are developing statewide estimates. Water savings estimates are from CALFED Ag WU Efficiency Technical Appendix and Colorado River Quantification Settlement Agreement.
The cost estimates are derived from potential on-farm and district wide efficiency improvements associated with "real water savings". Details of estimates and assumptions are in the CALFED WUE Program Plan (Final Programmatic EIS/EIR Technical Appendix- July 2000). Water savings and associated costs for All American Canal and Coachella Branch Canal lining are not included in the cost analysis.

(c), (d) Urban Water Use Efficiency – Reduce demand. 1) Bay Delta Program (2000) *Net Water Estimates;* and 2) Pacific Institute end use study (2003). Cost estimate in progress by staff.

(e) Conveyance – Cost estimated = $1.125 billion, as follows:
($1 billion for CALFED Delta conveyance improvements) + ($125 million for Lining of the All American and Coachella canals) = $1.125 billion total cost.

(f), (g) System Reoperation – Augment supply or redistribute water. Supply benefit is based on future implementation of the Bay Delta Program's Environmental Water Account from willing sellers reoperating local and regional surface water projects. Implementation of other resource management strategies will often result in system reoperation.

(h), (i) Water Transfers – Supply benefits associated with water transfers come from implementing other resource management strategies, in particular, agricultural water use efficiency, system reoperation, conjunctive management, and temporary land fallowing (included in agricultural lands stewardship). Cost estimate in progress by staff.

(j), (k) Conjunctive Management & Groundwater Storage – Augment supply. Conjunctive Management – The supply benefits were derived from: 1) Proposition 13 Groundwater Storage Applications to DWR for fiscal year 2001-2002; 2) Association of Groundwater Agencies report titled, "Groundwater and Surface Water in Southern California" (2000); 3) Natural Heritage Institute report titled, "Feasibility Study of a Maximal Program of Groundwater Banking" (1998); 4) U.S. Army Corps of Engineers report titled, "Conjunctive Use for Flood Protection" (2002); 5) Natural Heritage Institute report titled, "Estimating the Potential for In-Lieu Conjunctive Management in the Central Valley" (2002). Cost estimates are extrapolated from Proposition 13 Groundwater Storage Applications to DWR for fiscal year 2001-2002. Cost estimates assume that the supply benefit is not restricted by Delta export constraints or conveyance capacity.

(l), (m), (n), (o) Desalination – Augment supply. Information and data are from "DWR October 2003 report "Water Desalination - Findings and Recommendations", California Coastal Commission's 2003 draft report "Seawater Desalination and the California Coastal Act" and a DWR Desalination Database based on reports and articles in newspapers, newsletters, technical journals and trade journals." Primary information sources for the database are "Water Desalination Report" (weekly newsletter), International Desalination Association's Worldwide Desalting Plants Inventory series (issued biennially since 1970), "International Desalination & Water Reuse Quarterly" and California Water News, DWR's daily compilation of water news in California.

(p), (q) Precipitation Enhancement – Augment supply. DWR staff analysis (2004).
Cost estimated = $.2 billion, as follows: ($7 million/year for cloud seeding activities) x (25 years until 2030) + ($2 million for initial environmental studies) = $177 million.

(r), (s) Recycled Municipal Water – Augment supply. *Water Recycling 2030*; Recycled Water Task Force (2003).

(t), (u) Surface Storage - CALFED – Augment supply. Bay-Delta Program Storage Investigations staff (2003). Cost estimate based on DWR and U.S. Bureau of Reclamation report titled, "California Bay-Delta Surface Storage Program Progress Report," April, 2004.

(v) Surface Storage – Regional/Local – No statewide cost estimates available.

(w) Drinking Water Treatment & Distribution – Cost estimate based on a formal needs survey by the U.S. Environmental Protection Agency.

(x), (y) Groundwater/Aquifer Remediation – Supply augmentation by 2030 could be as high as 1 MAF per year if aquifers not presently being used are tapped. [1] Estimated investment by 2030 would be $20 billion.

[1] Groundwater that is presently being treated may continue to require treatment before use in 2030, and other current sources of groundwater may require treatment in the future. These sources are already a part of the supply, so there may be no net "supply augmentation." Nevertheless, remediation is required to maintain existing supplies.

(z) Matching Water Quality to Use – Cost estimate based on CALFED estimates.

(aa) Pollution Prevention – Cost estimate based on a formal needs survey by the U.S. Environmental Protection Agency.

(bb) Urban Runoff Management – Cost estimates are included under Pollution Prevention. See note (o) above.

(cc), (dd) Agricultural Lands Stewardship – Redistribute water. Potential supply benefits from temporary land fallowing or permanent land retirement.
Cost estimate = $5.3 billion, determined as follows:
Total cost is the sum of three components: (A) financial assistance, (B) technical assistance and (C) land acquisition.
A: USDA estimate of unmet need for its conservation cost-share programs = ($80 million/yr) X (25 yr until 2030) = $2 billion;
B: USDA estimate of unmet need for field staff = (800 persons) X ($90,000/yr/person) X (25 yr until 2030) = $1.8 billion
C: conservation easements on about 9% of 11.4 million total acres of farmland = (1 million acres) X $1500/acre = $1.5 billion
A + B + C = $2 billion + $1.8 billion + $1.5 billion = $5.3 billion.

(ee), (ff) Economic Incentives (Loans, Grants, and Water Pricing) – Supply benefits obtained indirectly by providing incentives for changes to water management behavior by agencies and individuals. Program administration cost is the only direct cost.

(gg) Ecosystem Restoration – Cost estimate = $7.5 –11.25 billion, as follows:
($150 million/year for CALFED activities) X (25 years until 2030) = $3.75 billion for CALFED area.
($3.75 billion) X (an expansion factor of 2 or 3 to cover areas outside CALFED) = $7.5 –11.25 billion

(hh) Floodplain Management – Cost estimate = $475 million, as follows:
($57 million for Flood Protection Corridor Program, disbursed over 3 years) = ($19 million/yr) X (25 years until 2030) = $475 million

(ii), (jj) Recharge Area Protection – The water supply benefit and associated cost is included in the strategy, conjunctive management and groundwater storage.

(kk) Urban Land Use Management – No statewide cost estimates available.

(ll) Water-Dependent Recreation – Cost estimate considers construction of 4, 100-site campgrounds, at $3.5 million each.
(4 campgrounds) x ($3.5 million/campground) = $14 million

(mm) Watershed Management – Costs for planning, communication, and decision making processes for local and regional watershed management efforts. Assessments, planning functions, public decision-making forums are the focus of most of the expenditures.

Period (years)	Assessment-Planning [2] ($ million)	Public Process [3] ($ million)	Projects [4] ($ million)	Total for period
2004-2009	$10 - 37.5	$8 - 16	$14 - 80	$160 - 667
2010-2015	$10 - 30	$8 - 16	$14 - 88	$160 - 804
2016-2030	$10 - 25	$8 - 16	$14 - 100	$160 – 2,115
Total				$480 – 3,586

[2]Assessment/Planning: From CALFED Finance Plan:
Annual cost 2004 period
- Assessment and Planning $4 million - $15 million,
- Public Process $2 million - $4 million, (listed as technical assistance in Finance Plan)

Annual cost 2010 period
- Assessment and Planning $4 million - $12 million
- Public Process, $2 million - $4 million

Annual cost 2016 period
- Assessment and Planning $4 million - $10 million
- Public Process, $2 million - $4 million

[3] The CALFED service area represents a portion of the State. For Assessment and Planning, the service area is estimated as 40% of statewide need and for Public Process as 25% of statewide need. Therefore, statewide Assessment and Planning = 2.5 x CALFED value, and Public Process = 4 x CALFED value.

[4] For Projects, CALFED service area is estimated to be 25% of the statewide need.

(nn) Regional Integrated Planning & Management – Assumes $1 million per hydrologic region per year.
($.001 billion/hydrologic region/year) x (10 hydrologic regions) x (25 years) = $250 million

(oo) Research & Development – Assumes $10 million per year for 25 years.
($.010 billion/year) x (25 years) = $250 million

(pp) Science – Costs for supporting science programs are assumed to be 3 to 5 percent of total implementation costs.